Science On a Sphere®
National Oceanic and Atmospheric Administration

Blue Marble (23 degree tilt)

Description

Media Preview

The Blue Marble is an incredibly detailed, true-color depiction of the Earth. NASA is responsible for this dataset made from a compilation of satellite images throughout 2001. Most of the information came from NASA's MODIS, the Moderate Resolution Imaging Spectroradiometer, which is attached to the Terra satellite 435 miles above Earth. The background image of the land and oceans was created using data from June through September of 2001. This could not be done in a single day or even a week because on any given day clouds are blocking a significant portion of the surface. The cloud image is a composite of three days worth of data. The first two days of data were collected in the visible wavelength and the third day was needed to get a view of the clouds over the poles using thermal infrared imagery.

The shading is true color with the oceans shades of blue, the clouds white and the lands varying from green to brown. The brown areas are the sands of the deserts. The shading of the land was done using a dataset compiled by the U.S. Geological Survey's Earth Resources Observation and Science Data Center.

Additional Blue Marble datasets are available to highlight some of the characteristics of the changing Earth. The standard Blue Marble is a year long composite to show an average view of the earth. The Blue Marble without clouds is also available in monthly composites the entire year. This monthly evolution is the seasonal blue marble. The monthly evolution allows audiences to see the changing appearance of the Earth due to the season changes. The most dramatic change is the expansion of the snow cover during the winter months and then the depletion of it during the summer months. **Blue Marble: Next Generation** provides an updated version of the seasonal changes dataset. The Blue Marble is also available without the cloud cover so that the vegetation can be clearly seen. This dataset has also been merged with the **Nighttime Lights** dataset, to create a new dataset. The new dataset shows the Earth with daytime and nighttime views of the Earth, to demonstrate how only half of the Earth is illumintated at one time.

Details

Category
Land

Audio
Yes

Dataset Source
NASA Goddard Space Flight Center

Dataset Developer
NASA Goddard Space Flight Center

Visualization Developer
NASA

Contact
Beth Russell

Directory
FTP Link

Keywords
Land, Solar System, Earth, Blue Marble

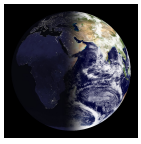
Notable Features

- Vastness of the Sahara Desert
- Shading done in true color: gives Earth's appearance from space

Related Datasets

Seasonal Blue Marble

Earth with Vegetation

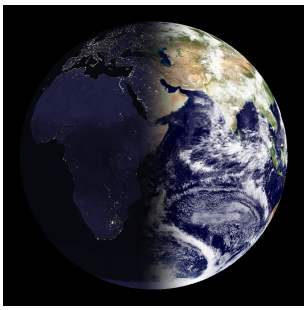


Blue Marble and Nightlights

Science On a Sphere®
National Oceanic and Atmospheric Administration

Blue Marble and Nightlights

Description



Media Preview

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Details

Category
Land

Audio
No

Dataset Source
NASA GSFC, DMSP

Dataset Developer
NASA GSFC, NGDC Earth Observations Group

Visualization Developer
Steve Albers, NOAA/GSD

Contact
Steve Albers

Directory
FTP Link

Keywords
Land, Solar System, Earth, Blue Marble

Notable Features

- Vastness of the Sahara Desert
- Shading done in true color: gives Earth's appearance from space

Related Datasets

Blue Marble (23 degree tilt)

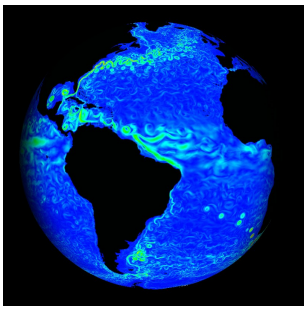
Seasonal Blue Marble

Earth with Vegetation

Science On a Sphere®
National Oceanic and Atmospheric Administration

NASA Sea Currents

Description



Media Preview

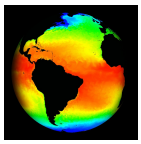
The water in the ocean is constantly moving. Ocean currents are typically driven by surface wind and can have a huge impact on climate. Northwest Europe is moderately temperate considering its latitude because the Gulf Stream off of the eastern coast of the United States transports warm water north to those areas. In fact, the Atlantic Ocean along the U.S. coast is much warmer than the Pacific Ocean along the U.S. coast because of the warm water transported in the Gulf Stream. In this visualization, a model created by NASA, the color variations denote speed. The lighter green areas are moving faster than the blue areas.

Along most of the coasts, where the water faces an obstacle, the water's velocity increases and eddies form. Eddies (small whirlpools) are most readily seen in streams, where they form behind rocks as the water flows around them. The eddies in the ocean follow the same priniciple, but are so large that they are hard to detect. Eddies can also spin off at the edges of currents as they travel through the oceans. An almost constant string of eddies is visible off of the northern coast of South America as an equatorial current from Africa crashes into South America. Eddies are also visible off of many islands around the world.

Notable Features

- The Gulf Stream winding its way along the east coast of the U.S.
- Eddies forming along almost all the coasts

Related Datasets



NASA Sea Surface Temperatures

Details

Category
Ocean

Audio
Yes

Dataset Source
Los Alamos National Labs and the Naval Postgraduate School

Dataset Developer
Los Alamos National Labs and the Naval Postgraduate School

Visualization Developer
Los Alamos National Labs and the Naval Postgraduate School

Contact
Beth Russell

Directory
FTP Link

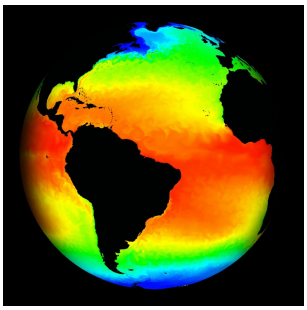
KML
KML File

Keywords
Ocean, model, NASA, current, eddy

Science On a Sphere®
National Oceanic and Atmospheric Administration

NASA Sea Surface Temperatures

Description



Media Preview

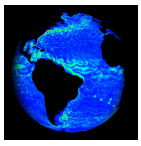
" Sea surface temperature plays a vital role in the behavior of the Earth's climate and weather. It is both a causal factor and a resulting effect of complex interactions of natural forces on Earth. NASA not only measures sea surface temperature from space using powerful scientific instruments, but it also studies temperature processes in advanced computer models." -Gretchen Cook-Anderson, Goddard Space Flight Center

While the coldest areas remain at the poles and the warmest area remains at the Equator, many of the seasonal variations linked to the ocean are visible in this dataset generated by a NASA computer model. The warmest water, which is shaded red, can be seen expanding from the equator during the summer. The East Coast of the U.S. warms steadily during the summer months and then cools in the fall and winter. Ocean currents are also visible, such as the Gulf Stream, which transports warm Gulf of Mexico water up the East Coast. Along the edges of many of the currents, ocean eddies (small whirlpools) can be seen mixing and dispersing the temperature gradients. Ocean eddies also appear along coasts, where land is an obstacle in the path of the water.

Notable Features

- North/South temperature gradient
- Seasonal variations in ocean temperature
- Currents and eddies

Related Datasets



NASA Sea Currents

Details

Category
Ocean

Audio
No

Dataset Source
Los Alamos National Labs and the Naval Postgraduate School

Dataset Developer
Los Alamos National Labs and the Naval Postgraduate School

Visualization Developer
Los Alamos National Labs and the Naval Postgraduate School

Contact
Beth Russell

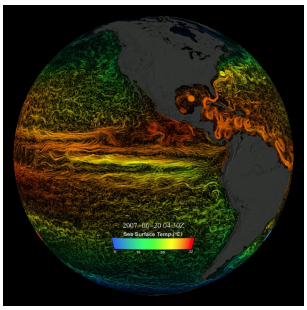
Directory
FTP Link

Keywords
Ocean, sea surface temperature, current, eddy, model

Science On a Sphere®
National Oceanic and Atmospheric Administration

Sea Surface Currents and Temperature with Gray Land

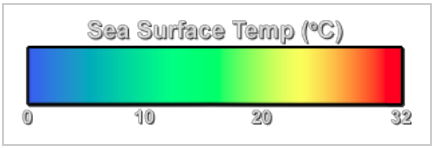
Description



Media Preview

To increase understanding and predictive capability for the ocean's role in future climate change scenarios, the NASA Modeling, Analysis, and Prediction (MAP) program has created a project called Estimating the Circulation and Climate of the Ocean, Phase II (ECCO2): High-Resolution Global-Ocean and Sea-Ice Data Synthesis. ECCO2 produces increasingly accurate syntheses of all available global-scale ocean and sea-ice data at resolutions that start to resolve ocean eddies and other narrow current systems, which transport heat, and other properties within the ocean. ECCO2 data syntheses are created by using the available satellite and in-situ data in the Massachusetts Institute of Technology General Circulation Model (MIT GCM). ECCO2 simulates ocean flows at all depths, but only surface flows are used in this visualization. The global sea surface current flows are colored by corresponding sea surface temperatures. The sea surface temperature data is also from the ECCO2 model.

These surface flows and temperatures represent only the top few meters of the oceans. They are primarily driven by the surface winds, traveling at about 3% of the speed of the winds. The distribution of solar energy from the equators to the poles also contributes to the currents, with the oceans responsible for 40% of the global heat transport.

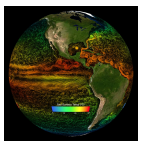


The dominant features are the five subtropical gyres caused by the surface winds. These gyres are centered around high pressure zones in the North Atlantic, North Pacific, South Atlantic, South Pacific, and the Indian Ocean. Circulation moves clockwise in the northern hemisphere, and counterclockwise in the southern hemisphere. The ocean circulations close to the equator are primarily east to west, again, in the direction of the surface winds. The rotating gyres include a northward flow in the western Atlantic and western Pacific moving the warm waters toward the north pole. The cooler waters flow south in the eastern Pacific and Atlantic in its return to the equator. There is one primary circulation in the Indian Ocean about the equator with seasonal variability. Below about 50 degrees south is the eastward circumpolar current around Antarctica, following the direction of the surface winds similar to the other major current systems. This visualization shows the ocean surface currents and temperatures around the world from March 2007 through March 2008.

Notable Features

- The visualization is a synthesis of all available global-scale ocean and sea ice data
- The global sea surface current flows are colored by corresponding sea surface temperature
- There are five subtropical gyres caused by the surface winds centered around high pressure zones in the North Atlantic, North Pacific, South Atlantic, South Pacific, and the Indian Ocean.

Related Datasets



Sea Surface Currents and Temperature with Veg Land

Details

Category
Ocean

Audio
No

Dataset Source
NASA Modeling, Analysis, and Prediction

Dataset Developer
NASA Modeling, Analysis, and Prediction

Visualization Developer
NASA Scientific Visualization Studio

Contact
NASA Scientific Visualization Studio

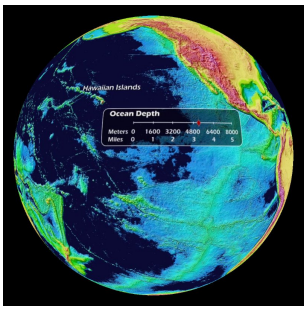
Directory
FTP Link

Keywords
Ocean, sea surface temperature, currents, circulation, model, NASA, ECCO2

Science On a Sphere®
National Oceanic and Atmospheric Administration

Ocean Drain with Etopo Background

Description



Media Preview

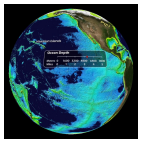
Beneath the sea surface is an amazing sea floor that contains mountain ranges, trenches and plains. The ocean covers 71% of the Earth's surface, has an area of 139,400,000 square miles and an average depth of 2.3 miles. Due to this vast size, only a few percent the sea floor has been mapped by ships. Maps of the sea floor are created by combining soundings from ships, sonar scans from ships, and gravity anomalies in the sea surface detected by satellites.

This dataset gradually reveals the sea floor as the ocean is "drained." The scale in the dataset shows the distance below sea level in meters and miles. As selected features are revealed, a label appears. For this animation, the labeled areas include Mariana Trench, Tonga Trench, Puerto Rico Trench, Hawaiian Islands, Grand Banks, Mid-Atlantic Ridge and Ninety East Ridge. The deepest area in the ocean is the Mariana Trench, which is 6.86 miles (11,033 meters) deep. The longest mountain range in the world is the Mid-Atlantic Ridge, which runs through the middle of the Atlantic Ocean. There are two versions on this dataset that are fully labeled with a colorized seafloor based on bathymetry, one with the land shaded in true color and one with the land shaded based on elevation. A third version of this dataset is available with no labels and the land shaded in true color with the oceans shaded gray.

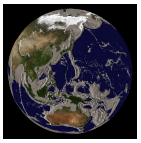
Notable Features

- Several prominent ridges and trenches are identified
- The scale shows the distance below sea level in meters and miles
- The deepest part of the ocean is in the Mariana Trench at 6.86 miles below sea level

Related Datasets



Ocean Drain with Land Background



Ocean Drain with Gray Ocean Floor

Details

Category
Ocean

Audio
No

Dataset Source
Walter Smith, NOAA

Dataset Developer
Walter Smith, NOAA

Visualization Developer
Dan Pisut, NOAA Environmental Visualization Lab

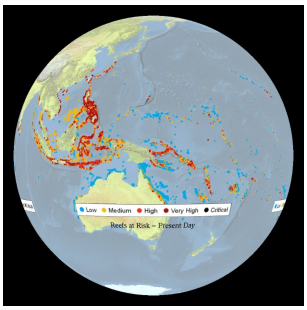
Contact
Walter Smith

Directory
FTP Link

Keywords
Ocean, sea floor, topography, mapping

Reefs at Risk

Description



Media Preview

From tourism to disease prevention, it's clear that reefs offer much more than recreation. According to the newly released **Reefs at Risk Revisited** report, coral reefs:

- Support more than 275 million people worldwide.
- Protect coastlines in more than 100 countries - helping defend against storms and erosion.
- Accounts for 15% of gross domestic product in more than 20 countries.
- Hold the potential to fight disease - including treatments for cancer, HIV, malaria, and other diseases.

Yet coral reefs today face serious threats. The new report finds that approximately 75% of world's coral reefs are currently threatened by local and global pressures. Local pressures pose the most immediate threat - especially from overfishing and destructive fishing, which is particularly widespread in Southeast Asia. Global threats from climate change and alterations in ocean chemistry (i.e. ocean acidification) are compounding the pressures on reefs. Climate change is causing ocean temperatures to rise, which, in turn, is leading to wide-spread coral bleaching.

This dataset for SOS looks at the present state of coral reefs and then into the future. The present image shows the threat category for coral reefs due to local activities such as overfishing and destructive fishing, marine-based pollution, coastal development, and watershed-based pollution. The projected images in 2030 and 2050 show local threats combined with projections of thermal stress and ocean acidification using a "business as usual" greenhouse gas emissions scenario. According to the report, left unchecked, combined local and global pressures will push 90 percent of coral reefs to threatened status (all non-blue colors) in less than 20 years (by 2030) and nearly all reefs will be threatened by 2050.

Image Details

Reefs are assigned their threat category from the integrated local threat index as a starting point. Threat is raised one level if reefs are at high threat from either thermal stress or ocean acidification, or if they are at medium threat for both. If reefs are at high threat for both thermal stress and acidification, the threat classification is increased by two levels. The analysis assumes no increase in future local pressure on reefs, and no reduction in local threats due to improvements in management.

Low Medium High Very High Critical

Notable Features

- At present, local human activities, coupled with past thermal stress, threaten an estimated 75 percent of the world's reefs.
- By 2030, estimates predict more than 90% of the world's reefs will be threatened by local human activities, warming, and acidification, with nearly 60% facing high, very high, or critical threat levels.
- By 2050, estimates predict nearly all of the reefs will be threatened, with 75% facing high, very high, or critical threat levels.

Related Datasets

(None)

Details

Category
Ocean

Audio
No

Dataset Source
World Resources Institute

Dataset Developer
World Resources Institute

Visualization Developer
NOAA Pacific Services Center

Contact
NOAA Pacific Services Center

Directory
FTP Link

Keywords
Ocean, coral reefs, climate change, fisheries, water

Science On a Sphere®
National Oceanic and Atmospheric Administration

Ocean Conveyor Belts Animation

Description

Media Preview

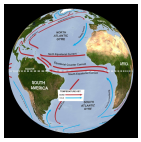
The ocean is not a still body of water. There is constant motion in the ocean in the form of a global ocean conveyor belt due to thermohaline currents. These currents are density driven, which are affected by both temperature and salinity. Cold, salty water is dense and sinks to the bottom of the ocean while warm water is less dense and rises to the surface. The "start" of the ocean conveyor belt is in the Norwegian Sea. Warm water is transported to the Norwegian Sea by the Gulf Stream. The warm water provides heat for the atmosphere in the northern latitudes that gets particularly cold during the winter. This loss of heat to the atmosphere makes the water cooler and denser, causing it to sink to the bottom of the ocean. As more warm water is transported north, the cooler water sinks and moves south to make room for the incoming warm water. This cold bottom water flows south of the equator all the way down to Antarctica. Eventually, the cold bottom waters are able to warm and rise to the surface, continuing the conveyor belt that encircles the global. It takes water almost 1000 years to move through the whole conveyor belt.

There are two datasets that illustrate the ocean circulation. The first dataset is an animation that shows the movement of the ocean conveyor belt and the second dataset is a still image that has the major ocean currents labeled. In both datasets, surface waters are the red lines and cold, bottom waters are the blue lines. Changes in ocean circulation could have drastic impacts on the climate. The transport of heat associated with the ocean conveyor belt partially moderates the cold temperatures in the North. As the poles warm due to climate change, melt water from ice and glaciers enters the ocean. This fresh melt water has the potential to slow or even shut off the ocean circulation, which is dependent on temperature and salinity. The density of the fresh melt water is less than that of salty ocean water. This causes the fresh melt water to form a layer on the surface that can block the warm, salty ocean water from transporting heat to the atmosphere. The effect would be a cooling of the higher latitudes. If the warm water is not able to give off heat, it can not cool and sink to the bottom of the ocean. This would disturb the circulation of the entire ocean conveyor belt and have a noticeable impact on the climate in the northern latitudes.

Notable Features

- Cold bottom currents are blue, warm surface currents are red
- Transport through the whole conveyor belt can take up to 1000 years
- Currents are labeled in the Ocean Circulation dataset

Related Datasets



Ocean Circulation

Details

Category
Ocean

Audio
No

Dataset Source
NASA Goddard Space Flight Center

Dataset Developer
NASA Goddard Space Flight Center

Visualization Developer
NASA Goddard Space Flight Center

Contact
NASA Goddard Space Flight Center

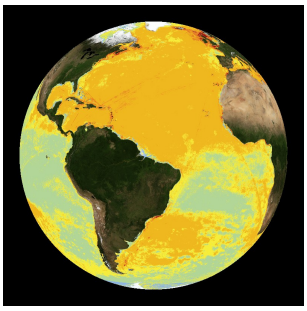
Directory
FTP Link

Keywords
Ocean, conveyor belt, currents, climate change

Science On a Sphere®
National Oceanic and Atmospheric Administration

Extent of Harmful Human Influences on Global Marine Ecosystems

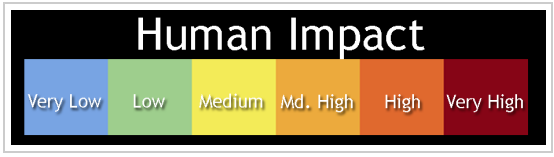
Description



Media Preview

The ocean has an impact on the lives of everyone on Earth, even those who don't live on the coasts. It has been estimated that one in every six jobs in the United States is marine-related and that 50% of all species on Earth are supported by the ocean. Because of this, it is important to protect and preserve the oceans. Humans however have been shown to have a negative impact on the oceans. A report issued in February 2008 found that 40% of the world's oceans are heavily impacted by human activities, such as overfishing and pollution. In all 17 different human activities were examined in the report, including fertilizer run-off, commercial shipping, and indirect activities such as changes in sea surface temperature, UV radiation, and ocean acidification.

This dataset is a map that was put together from the data compiled from the report, A Global Map of Human Impact on Marine Ecosystems, which was published in Science Magazine (**see full text**). In addition to finding that 40% of the world's oceans are heavily impacted by human activities, researchers also concluded that no area is unaffected by human influence. However, there are large areas that have relatively low human impact, especially near the poles. The areas where humans have had the worst impact include the East Cost of North America, North Sea, South and East China Seas, Caribbean Sea, Mediterranean Sea, Red Sea, Persian Gulf, Bering Sea and the western Pacific Ocean. Areas that are shaded red have a high human impact and blue areas have a very low human impact. The study also examined 20 marine ecosystems to determine the impact of the human influences. The ecosystems that are most threatened are coral reefs, seagrass beds, and mangroves.



NOAA press release

Notable Features

- 40% of the world's oceans are heavily impacted by human activities
- The areas with the least impact are near the poles

Related Datasets

(None)

Details

Category
Ocean

Audio
No

Dataset Source
Benjamin S. Halpern, Shaun Walbridge, Kimberly A. Selkoe, Carrie V. Kappel, Fiorenza Micheli, Caterina D'Agrosa, John F. Bruno, Kenneth S. Casey, Colin Ebert, Helen E. Fox, Rod Fujita, Dennis Heinemann, Hunter S. Lenihan, Elizabeth M.P. Madin, Matthew T.

Dataset Developer
NOAA Environmental Visualization Program

Visualization Developer
NOAA Environmental Visualization Program

Contact
Beth Russell

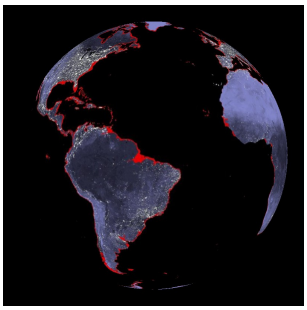
Directory
FTP Link

Keywords
Ocean, ecosystems, pollution, human impacts

Science On a Sphere®
National Oceanic and Atmospheric Administration

Impact of 6 meter Sea Level Rise (red)

Description



Media Preview

There are many questions surrounding climate change. One big question is how the changing climate will affect the oceans. The sea level has been steadily rising since 1900 at a rate of 1 to 2.5 millimeters per year. In fact, since 1992 new methods of satellite altimetry using the TOPEX/Poseidon satellite indicate a rate of rise of 3 millimeters per year. The Fourth Assessment Report from the IPCC states that "there is strong evidence that global sea level gradually rose in the 20th century and is currently rising at an increased rate, after a period of little change between AD 0 and AD 1900. Sea level is projected to rise at an even greater rate in this century. " - **Fourth Assessment Report on Sea Level Rise** Sea level can rise by two different mechanisms with respect to climate change. The first is the expansion of the sea water as the oceans warm due to an increasing global temperature. The second mechanism is the melting of ice over land, which then adds water to the ocean. The IPCC Fourth Assessment Report predicts that total global-average sea level rise from 1990 - 2100 will be 7 - 15 inches for low emission scenarios and 10 - 23 inches for high emission scenarios.

There are two Science On a Sphere datasets that demonstrate rising sea levels and show the changes in the Earth's appearance as the sea levels rise. The first dataset starts with sea level 150 meters below its present level. The areas that appear white are land that would be uncovered if the sea level was below the current level. The animation proceeds in 10 meter increments, increasing up to 80 meters above the current sea level. Current land masses that would be covered by the rising sea level are shaded black. The National Snow and Ice Data Center predicts that if both Antarctica and Greenland, the world's largest ice sheets, both melted completely, the sea level would rise more than 70 meters. The second dataset shows the sea level rising meter by meter from current sea level up to 6 meters above sea level. The land that would be covered by water is shaded red to show the drastic decrease in land as the waters rise. The same dataset is also available with black shading for land covered by water.

Details

Category
Ocean

Audio
No

Dataset Source
John C. Kostelnick, College of Mathematics and Natural Sciences, Haskell Indian Nations University

Dataset Developer
John C. Kostelnick, College of Mathematics and Natural Sciences, Haskell Indian Nations University

Visualization Developer
NASA Goddard Space Flight Center

Contact
NASA Goddard Space Flight Center

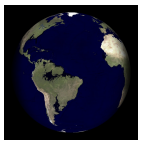
Directory
FTP Link

Keywords
Ocean, sea level, climate change

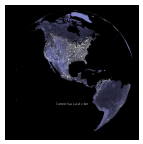
Notable Features

- Shading in either red or black represents land that would be covered by rising sea levels
- Much of the eastern United States disappears when levels rise above current level

Related Datasets



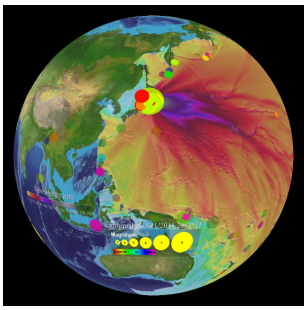
Sea level Changing in every 10 meters from SMM



Impact of 6 meter Sea Level Rise (black)

Japan Earthquake and Tsunami Wave Heights Merged

Description



Media Preview

On March 11, 2011 at 2:45 local time, a 9.0 magnitude earthquake occurred 81 miles (130 km) off the east coast of Sendai, Japan, triggering a massive tsunami. It is estimated that the initial tsunami wave took 10 to 30 minutes to make its first landfall. Forecasted wave heights were up to 33 ft (10 m) and there were many reports of tsunami waves three stories high in parts of Japan. Across the Pacific Ocean, many countries issued evacuations along the coasts because of the predicted tsunami waves.

There are several datasets related to this event. The first is a model run of predicted tsunami wave heights from the Center for Tsunami Research at the NOAA Pacific Marine Environmental Laboratory. It shows the predicted wave heights of the tsunami as it travels across the Pacific basin. The largest wave heights are near the earthquake epicenter, off Japan. The wave decreases in height as it travels across the deep Pacific but grows taller as it encounters shallow waters near coastal areas. In general, the energy of the wave decreases with distance, causing the maximum height of the waves at the coasts to decrease. This explains why coastal Hawaii does not see the heights that were encountered in coastal Japan. Out in the open ocean, areas of low wave height correspond to deeper areas in the ocean.

To show the earthquake activity, a snapshot of the Real-Time Earthquake dataset has been archived. This loop, which is composed of hourly images, starts on February 19, 2011 and runs through March 24, 2011. Increased activity near Japan can be seen in the days before March 11. After the event, hundreds of powerful aftershocks, occurred for days. Over thirty of the aftershocks had a magnitude of greater than 6. In addition, a third dataset has been created by merging the earthquake activity with the predicted tsunami wave heights.

Details

Category
Land

Audio
No

Dataset Source
United States Geological Survey

Dataset Developer
NASA GSFC

Visualization Developer
Steve Albers, NOAA/GSD, NASA GSFC

Contact
Steve Albers

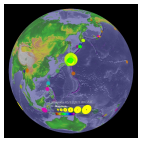
Directory
FTP Link

Keywords
Ocean, Tsunami, PMEL, Japan, Earthquake

Notable Features

- The earthquake had a magnitude of 9.0 and was followed by over thirty aftershocks with a magnitude of over 6.0
- The predicted wave heights are the height of the waves in the open ocean

Related Datasets

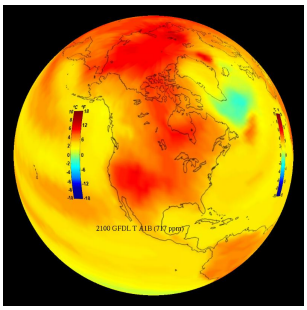


Japan Earthquake

Science On a Sphere®
National Oceanic and Atmospheric Administration

GFDL a1b Temp Change 1870-2100

Description



Media Preview

"The Intergovernmental Panel on Climate Change (IPCC) was established by WMO and UNEP to assess scientific, technical and socio- economic information relevant for the understanding of climate change, its potential impacts and options for adaptation and mitigation. It is open to all members of the UN and of WMO." - **from www.ipcc.ch** In an effort to better visualize the future of climate change, the IPCC releases assessment reports on the current state of the atmosphere and what the future could hold. Models from various atmospheric and oceanic organizations are included in these reports in order to establish a broad understanding of the science. Data from three of the IPCC models following temperature change from 1870 - 2100 have been formatted for Science On a Sphere®.

The models available on SOS are the **Climate Model 2.1, developed by the Geophysical Fluid Dynamics Laboratory;** the Community Climate System Model 3.0, developed by the National Center for Atmospheric Research; and the Hadley Centre HadCM3, developed by the United Kingdom Meteorology Office. All three models have similar forcing agents. For the past data they use the 20th Century Model 20C3M, which takes into account the historical record of greenhouse gases, sulfate aerosol concentrations, volcanic aerosol optical depths, and historical solar irradiation. For the future, there are two variations. Each model is available using the Special Report on Emissions Scenarios, SRES, A1B scenario, which assumes:

- Rapid economic growth
- A global population that reaches 9 billion in 2050 and then gradually declines.
- The quick spread of new and efficient technologies.
- A convergent world - income and way of life converge between regions. Extensive social and cultural interactions worldwide.
- A balanced emphasis on all energy sources

In addition, each model is also available using the more ecologically friendly SRES B1 scenario, which assumes:

- Rapid economic growth as in A1, but with rapid changes towards a service and information economy.
- Population rising to 9 billion in 2050 and then declining as in A1.
- Reductions in material intensity and the introduction of clean and resource efficient technologies.
- An emphasis on global solutions to economic, social and environmental stability.

Even though the all the models use the same inputs, the results vary because each of the three models have differing dynamics and physics parameterizations. In all of the models for the A1B scenario, CO2 production increases until it reaches 717ppm in the year 2100. For the B1 scenario, CO2 production increases until it reaches 621 ppm in the year 2100. The temperatures displayed in the datasets are all a comparison to temperatures in 2000. Blue tones on the visualization represent temperatures cooler than those in 2000, while red tones represent temperatures warmer than those in 2000.

In addition to the six model runs, there is a also a dataset has frames from the A1B and B1 scenario as modeled by GFDL for 2025, 2050, 2075, and 2100 in order to compare and contrast the differences between the two scenarios.

Notable Features

Model and Scenario	Global Mean Warming	North America Mean Warming
GFDL B1	2.7F (1.5C)	4.32F (2.4C)
GFDL A1B	5.22F (2.9C)	8.82F (4.9C)
CCSM B1	2.52F (1.4C)	3.24F (1.8C)
CCSM A1B	4.86F (2.7C)	7.56F (4.2C)
HAD B1	3.42F (1.9C)	5.4F (3.0C)
HAD A1B	6.66F (3.7C)	10.26F (5.7C)

Note: Global Mean Warming and North America Mean Warming are the difference between decadal averages for 1990-2000 and 2090-2100.

Details

Category
Models/Simulations

Audio
No

Dataset Source
Geophysical Fluid Dynamics Laboratory

Dataset Developer
Geophysical Fluid Dynamics Laboratory

Visualization Developer
Nikki Prive, NOAA/GSD

Contact
Dan Pisut, NOAA/NESDIS

Directory
FTP Link

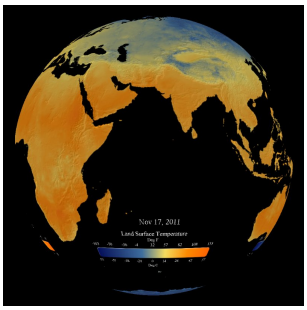
KML
KML File

Keywords
Models and Simulations, CO2, global warming, temperature, GFDL, NCAR, UKMET

Science On a Sphere®
National Oceanic and Atmospheric Administration

Real-time: Land Surface Temperature

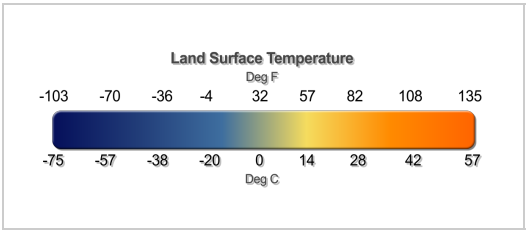
Description



Media Preview

Touch the ground and you will feel the land surface temperature. Satellites can also measure this temperature from space, and that data is plotted here. Though related, land surface temperature is not the same as air temperature since the land surface heats and cools more quickly than air. Land surface temperature is also greatly influence by land use and cover: bare, un-vegetated lands such as deserts are able to heat up to much greater temperatures than areas at the same latitude that are forested. This data is extensively used for modeling weather and climate, along with applications such as agriculture.

The data plots shown here are generated by averaging all of the data collected by the NOAA AMSU and DMSP SSM/I microwave sensors from 4 different polar-orbiting satellites over a 24 hour period. Blue areas are cool and orange areas are warm.



Details

Category
Land

Audio
No

Dataset Source
NOAA

Dataset Developer
NOAA Visualization Lab

Visualization Developer
NOAA Visualization Lab

Contact
NOAA Visualization Lab

Directory
FTP Link

Keywords
Land, surface temperatures, seasons

Notable Features

- Areas of higher altitude tend to be cooler than surrounding areas
- Land surface temperature is strongly influenced by land use and cover

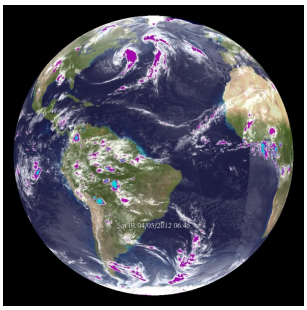
Related Datasets

(None)

Science On a Sphere®
National Oceanic and Atmospheric Administration

Real-time: Color Enhanced Infrared Satellite

Description



Media Preview

Infrared satellite images are used by meteorologists to determine where clouds are, but more importantly, how the clouds are moving. The infrared, IR, satellites work by measuring the infrared radiation that is emitted. Because the emitted radiation is proportional to temperature, the data are converted to temperature values, which can be useful for meteorologists. In comparison to clouds, the Earth's surface, even on very cold nights, is warm. When there are clouds, they absorb the radiation emitted by the Earth below and emit their own radiation at a much cooler temperature. Any area that has clouds shows up cooler than the ground, allowing meteorologists to detect the locations of the clouds. The height of clouds is inversely proportional to temperature, meaning that the tallest clouds are the coldest. It is often the tallest clouds that bring the most severe weather.

The satellites that collect these data are geostationary, meaning that they rotate at the same rate as the Earth so that the satellites are over the same spot on Earth all the time. This allows them to collect a continuous stream of data for one location so that "movies" of the data can be made. Over the United States there are two such satellites, the GOES (Geostationary Operational Environmental Satellites) -East and GOES-West. World wide there are many such satellites. This dataset is a composite of GOES, Meteosat, and GMS satellite data. Meteosat and GMS are similar to GOES, but operated by other countries. This real-time, color enhanced dataset is shaded so that the significant clouds are brightly colored in order to stand out from the surface. The lowest clouds are white, medium level clouds are shades of purple, and the highest clouds are teal. The background of this image is the "Blue Marble." The data is constinently updated so that the past thirty days of data are available.

Also available is a collection of biweekly IR satellite interpretations by NOAA scientists that can be used with this dataset. The interpretations are plain-language descriptions of notable climate and weather events visible in the cloud patterns of the two-week period indicated. Interpretations are posted every other Tuesday, and are available for the past six months. The interpretations are made available by the American Museum of Natural History, NOAA Climate Prediction Center, and NOAA National Climatic Data Center. To request access to this Google Docs collection please write Laura Allen at laura@amnh.org.

Details

Category
Atmosphere

Audio
No

Dataset Source
MTSAT

Dataset Developer
Fred Mosher, AWC Steve Albers, NOAA/GSD

Visualization Developer
Steve Albers, NOAA/GSD

Contact
Steve Albers

Directory
FTP Link

Keywords
Atmosphere, IR satellite, real-time, color enhanced, satellite

Notable Features

- Lowest clouds white, medium level clouds purple, and highest clouds teal
- Available in real-time

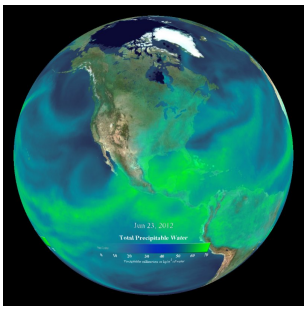
Related Datasets

(None)

Science On a Sphere®
National Oceanic and Atmospheric Administration

Real-time: Total Precipitable Water

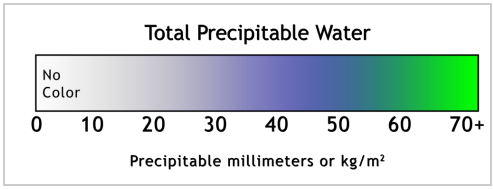
Description



Media Preview

The atmosphere contains an enormous amount of moisture that circulates around the globe. However, not all of it actually condenses into rain, sleet, or snow since the right balance of pressure and temperature are needed to create precipitation. Total precipitable water (TPW) in the atmosphere is the amount of water that can be obtained from the surface to the "top" of the atmosphere if all of the water and water vapor were condensed to a liquid phase. Significant features that can be identified in TPW data are the atmospheric rivers that flow off the oceans and onto coastal land areas. A famous example is the Pineapple Express that forms in the Northeast Pacific and impacts the Northwest United States. Also notice how TPW values are much greater over the equator and ocean. High levels of evaporation in these areas are one of the primary drivers of atmospheric circulation.

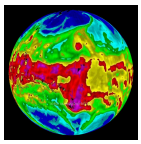
The land, ocean, and atmosphere all emit microwave radiation which can be measured by sensors on satellites, allowing scientists to study various aspects of the Earth. Microwave sounders are able to measure very low levels of microwave radiation naturally emitted by the Earth at different frequencies. Even water vapor emits microwave radiation that can be measured by microwave sounders. There are two datasets for TPW for Science On a Sphere. The first dataset uses data from the Advanced Microwave Sounding Unit, AMSU, which is attached to the NOAA Polar Environmental Orbiting Satellites NOAA 15, NOAA 16, and NOAA 17. Each satellite provides full coverage of the Earth everyday by orbiting the globe 14.1 times per day collecting a swath of data 1426 miles wide on each orbit. The second dataset uses data from the AMSU and the Special Sensor Microwave Imager, SSM/I, which is carried on Defense Meteorological Satellite Program satellites. Both are provided in near real-time. The AMSU dataset is updated hourly and the AMSU/SSMI combined dataset is updated daily.



Notable Features

- Tropics generally have high total precipitable water
- Areas of high total precipitable water typically indicated clouds and precipitation

Related Datasets



Real-time: NESDIS AMSU - Precipitable H2O

Details

Category
Atmosphere

Audio
No

Dataset Source
Advanced Microwave Sounding Unit Project and Special Sensor Microwave Imager

Dataset Developer
NOAA Visualization Lab

Visualization Developer
NOAA Visualization Lab

Contact
NOAA Visualization Lab

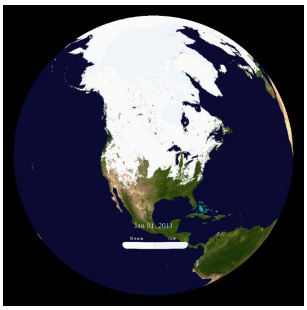
Directory
FTP Link

Keywords
Atmosphere, total precipitable water, satellite

Science On a Sphere®
National Oceanic and Atmospheric Administration

Real-time: Snow and Ice Cover

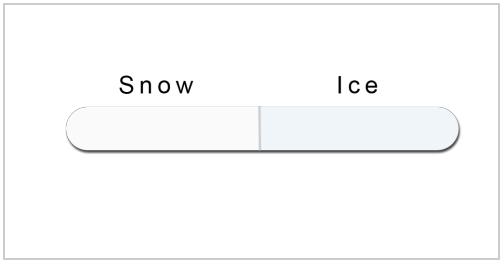
Description



Media Preview

The cryosphere (areas covered by ice, snow, glaciers, or permafrost) is an extremely dynamic part of the global system. Changes in the seasons and climate bring great changes to the extent of Earth's cryosphere. Using satellite data allows scientists to keep a continual eye on these areas.

Infrared and microwave data from multiple satellites including the NOAA's GOES Imager and POES AVHRR, US Air Force DMSP/SSMI, and EUMETSAT MSG/SEVIRI sensors is combined to create these daily maps of global snow and ice cover of the planet. Using multiple datasets provides relatively high spatial resolution (about 4 km/pixel) daily maps in all weather conditions. Light blue areas indicate sea ice extent, whereas white colors indicate all other areas of the cryosphere. This SOS dataset is updated on a daily basis in near real-time.



Details

Category
Ocean

Audio
No

Dataset Source
NOAA, USAF, EUMETSAT

Dataset Developer
NOAA

Visualization Developer
NOAA Visualization Lab

Contact
NOAA Visualization Lab

Directory
FTP Link

Keywords
Ocean, snow, sea ice, real-time

Notable Features

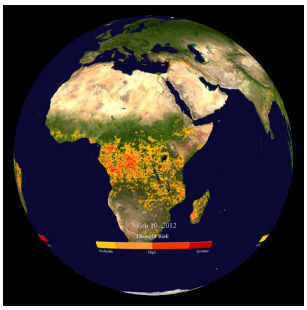
- The seasonal variations are very clear
- During the winter months, the effects of passing snow storms is visible
- In the Northern Hemisphere, the minimum ice concentration occurs in September and the maximum is in March

Related Datasets

(None)

Real-time: Drought Risk

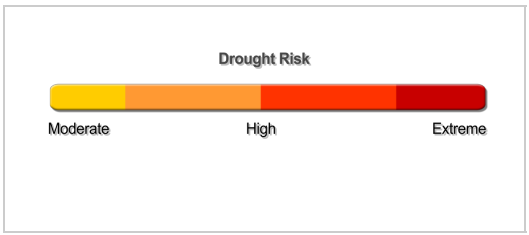
Description



Media Preview

Satellites can detect the difference between rock, grassland, and forests because these surfaces emit energy differently back into space. By measuring these differences and observing the patterns of vegetation --or its lack of growth--NOAA scientists can monitor how droughts are changing across the world through time.

This global drought risk composite is derived from the Normalized Difference Vegetation Index datasets developed by NOAA from measurements of the AVHRR sensor onboard the POES satellite. By monitoring vegetation health, moisture and thermal conditions, scientists are able to identify areas that are considered to be vegetatively stressed due to drought. An important note is that the drought imagery is based solely on the analysis of vegetation health and stress, not soil moisture conditions. But this index serves as a reliable proxy measurement for drought worldwide. Areas of desert and snow cover are not included in the analysis. Yellow areas indicate areas under moderate drought conditions; red indicates areas experiencing extreme drought conditions. A number of other datasets are also being derived from NDVI, including risk indexes for wildfires and malaria. This dataset is updated weekly.



Details

Category
Land

Audio
No

Dataset Source
NOAA

Dataset Developer
NOAA Visualization Lab

Visualization Developer
NOAA Visualization Lab

Contact
NOAA Visualization Lab

Directory
FTP Link

Keywords
Land, drought, seasons

Notable Features

- Location and intensity of drought changes with the seasons
- Drought Risk is updated weekly

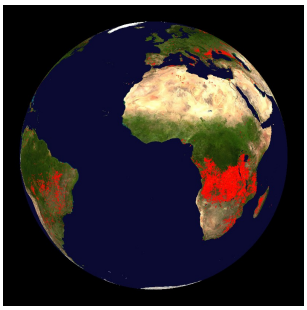
Related Datasets

(None)

Science On a Sphere®
National Oceanic and Atmospheric Administration

Global Fire Maps

Description



Media Preview

In order to monitor the fires occurring globally, a special sensor has been mounted on the Terra and Aqua satellites. The sensor, named the Moderate Resolution Imaging Spectroradiometer (MODIS), is able to provide daily satellite images of the Earth's landmasses in near real-time using the MODIS Rapid Response System. There are many uses for the data collected from MODIS, such as monitoring global fires by detecting the abnormally high temperature anomalies at the surface. When a location is much warmer than the surrounding area, it suggests the presence of a fire or a lava flow. It is important to know the size, location and intensity of fires because of the damage that they can cause, and also to help scientists understand the emissions from the fires and their short- and long-term effects on ecosystems.

The fire maps available for Science On a Sphere® display all of the fires accumulated over 10 day periods. Over the course of a year, 37 maps are generated. (The 37th map includes a few days from the following year.) Every fire that occurred over the 10 day period is indicated by a dot. The dots are colored from red to indicate a low fire count through yellow to indicate a high fire count. The location of widespread fires varies through the year with the seasons. Some of the fires are prescribed fires, which are set to prevent really large uncontrollable fires in the future. In the United States, approximately two million acres are burned in prescribed fires every year, with many more million acres burned in wild fires. The years 2000 and 2007 are available for display.

Notable Features

- Each frame displays the fires accumulated over a 10 day period
- Each dot indicates a fire
- Shading ranges from red for a low fire count to yellow for a high fire count
- Maps are available for 2000 and 2007

Related Datasets

(None)

Details

Category
Land

Audio
No

Dataset Source
MODIS Rapid Response System

Dataset Developer
MODIS Rapid Response System at NASA/GSFC

Visualization Developer
MODIS Rapid Response System at NASA/GSFC

Contact
NASA/GSFC

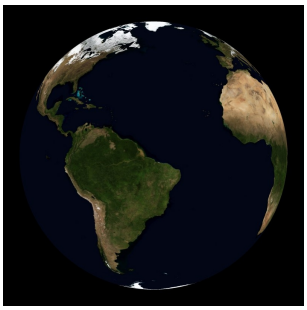
Directory
FTP Link

Keywords
Fire, satellites, MODIS, Terra, Aqua

Science On a Sphere®
National Oceanic and Atmospheric Administration

Seasonal Blue Marble

Description



Media Preview

The Blue Marble is an incredibly detailed, true-color depiction of the Earth. NASA is responsible for this dataset made from a compilation of satellite images throughout 2001. Most of the information came from NASA's MODIS, the Moderate Resolution Imaging Spectroradiometer, which is attached to the Terra satellite 435 miles above Earth. The background image of the land and oceans was created using data from June through September of 2001. This could not be done in a single day or even a week because on any given day clouds are blocking a significant portion of the surface. The cloud image is a composite of three days worth of data. The first two days of data were collected in the visible wavelength and the third day was needed to get a view of the clouds over the poles using thermal infrared imagery.

The shading is true color with the oceans shades of blue, the clouds white and the lands varying from green to brown. The brown areas are the sands of the deserts. The shading of the land was done using a dataset compiled by the U.S. Geological Survey's Earth Resources Observation and Science Data Center.

Additional Blue Marble datasets are available to highlight some of the characteristics of the changing Earth. The standard Blue Marble is a year long composite to show an average view of the earth. The Blue Marble without clouds is also available in monthly composites the entire year. This monthly evolution is the seasonal blue marble. The monthly evolution allows audiences to see the changing appearance of the Earth due to the season changes. The most dramatic change is the expansion of the snow cover during the winter months and then the depletion of it during the summer months. **Blue Marble: Next Generation** provides an updated version of the seasonal changes dataset. The Blue Marble is also available without the cloud cover so that the vegetation can be clearly seen. This dataset has also been merged with the **Nighttime Lights** dataset, to create a new dataset. The new dataset shows the Earth with daytime and nighttime views of the Earth, to demonstrate how only half of the Earth is illumintated at one time.

Details

Category
Land

Audio
No

Dataset Source
NASA Goddard Space Flight Center

Dataset Developer
NASA Goddard Space Flight Center

Visualization Developer
NASA

Contact
Beth Russell

Directory
FTP Link

Keywords
Land, Solar System, Earth, Blue Marble

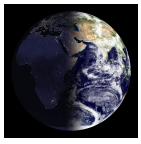
Notable Features

- Vastness of the Sahara Desert
- Shading done in true color: gives Earth's appearance from space

Related Datasets

Blue Marble (23 degree tilt)

Earth with Vegetation

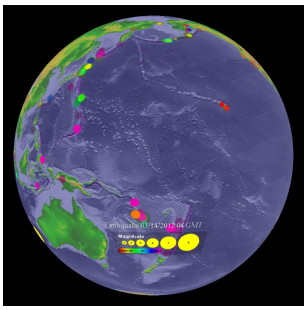


Blue Marble and Nightlights

Science On a Sphere®
National Oceanic and Atmospheric Administration

Real-time: Earthquake Hi-res Animation (2K - with legend)

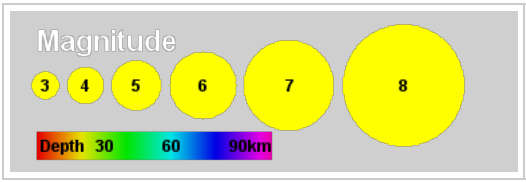
Description



Media Preview

Earthquakes occur naturally everyday. Anything that causes seismic waves to radiate throughout the Earth is an earthquake. There are two main types of earthquakes, tectonic and anthropogenic (caused by humans). Tectonic earthquakes are naturally occurring and are caused by earth movement. The surface of the Earth is composed of a mosaic of tectonic plates moving with respect to each other. When two plates glide past one another, a stress builds up at the boundary. When that stress reaches a critical level, the boundary slips and the result is an earthquake. The traces of repeated slips are known as fault lines. Anthropogenic earthquakes can be caused by drilling for fossil fuels, extraction of minerals, huge explosions, and the collapse of large buildings.

Most earthquakes are small enough to hardly be noticed; however, some can be very powerful causing widespread death and destruction and can even trigger tsunamis. The Richter magnitude scale was created to rate the strength and magnitude of earthquakes. It is a base-10 logarithm scale of ground motion 100km from the epicenter. Each increase of 1 magnitude means 10 times greater ground motion. To measure the amount of energy that was released during an Earthquake, a base 32 logarithm scale is used. This real-time dataset shows the earthquakes that daily happen around the world that are greater than 2.5 on the Richter scale. With the current database from the USGS, many earthquakes outside of the United States under 4-5 magnitude on the Richter scale are not reported. The size of the circle is proportional to the magnitude of the earthquake, with bigger values on the Richter scale represented by bigger circles. The coloring of the circles is based on the depth of the earthquake below the surface according to the provided color bar. After an earthquake occurs, the representing circle fades out over a seven day period. This dataset is updated hourly.



Details

Category
Land

Audio
No

Dataset Source
United States Geological Survey

Dataset Developer
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Directory
FTP Link

Keywords
Land, earthquake, plate tectonics, real-time

Notable Features

- Circles indicate earthquake; size indicates magnitude, color indicates depth
- Majority of earthquakes along plate boundaries

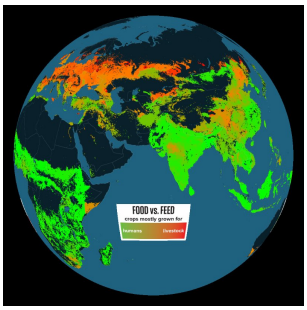
Related Datasets

(None)

Science On a Sphere®
National Oceanic and Atmospheric Administration

Food vs. Feed

Description



Media Preview

Not all cropland is used for producing food directly for people. A lot of the food crops grown are actually used as feed for animals. This map shows which regions produce crops that are mostly consumed directly by humans (in green), which regions produce about the same amount of human food and animal feed (in orange), and where most of the crops are used as animal feed (in red).

As discussed in **2 Billion More Coming to Dinner**, the conversion of crops to meat is not particularly efficient (in the case of cattle, for example, about 30 pounds of feed are needed to grow a single pound of beef), so as global demand for meat rises, cropland devoted to growing animal feed will have to increase proportionately. What effect will this have on the cost of meat, crops, and our diets?

Notable Features

- Green - crops consumed mostly by humans
- Orange - crops consumed equally by humans and animals
- Red - crops consumed mostly by animals

Related Datasets

(None)

Details

Category
Land

Audio
No

Dataset Source
University of Minnesota/Institute on the Environment/Global Landscapes Initiative

Dataset Developer
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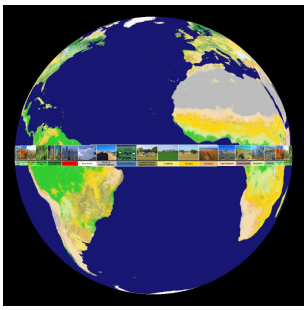
Directory
FTP Link

Keywords
Land, cropland, pastureland, animals, meat, food

Science On a Sphere®
National Oceanic and Atmospheric Administration

Land Cover Map with Ribbon of Labels

Description



Media Preview

The Moderate Resolution Imaging Spectroradiometer (MODIS) instrument on NASA's Terra satellite provides scientists with a new view of the Earth. Using data collected by MODIS, researchers at Boston University were able to create these land cover maps. Understanding the land cover of Earth aids policy makers involved in natural resource management. The maps are also critical for scientists as they study changes in the Earth system and as they model the Earth system. For example, in order to calculate the carbon budget for the Earth system, scientists can use these maps to determine the extent of vegetation covering the land surface that is absorbing carbon dioxide. Each of the varying land types have different impacts on the Earth system. Snow and ice cover cool the planet by reflecting sunlight back to space, forests absorb huge amounts of carbon dioxide, and croplands and urban areas reflect the human impact on the Earth.

The data that was analyzed for this map was collected by MODIS from November 2000 through October 2001. This map is the most refined global picture ever created of the distribution of Earth's ecosystems and land use patterns. The spatial resolution of this land cover map is 1 kilometer (.6 miles), a noted improvement on older versions of similar maps. The map is color coded based on 16 different land cover types. The land cover types fall into one of two categories, natural vegetation and agricultural, urban, and barren. There are eleven natural vegetation land types, ranging from Evergreen Needleleaf Forests to Permanent Wetland. The remaining five land types vary from croplands to snow and ice to urban and built-up. There are three versions of this dataset. Two show the same map base map, but have different label styles. One shows all of the labels in a ribbon around the equator and the other has a slide show of each land type. The third version shows each of the categories separately then progressively overlays the layers.

Classification	Percentage of Global Surface Coverage	Percentage of Land Surface Coverage
Permanent Snow and Ice	11.46%	33.79%
Open Shrublands	5.57%	16.42%
Barren/Sparsely Vegetated	3.22%	9.50%
Grasslands	2.27%	6.70%
Croplands	2.19%	6.45%
Evergreen Broadleaf	1.92%	5.66%
Woody Savannas	1.83%	5.40%
Savannas	1.38%	4.08%
Mixed Forests	1.33%	3.93%
Evergreen Needleleaf	1.31%	3.86%
Cropland/Natural Vegetation	0.49%	1.43%
Deciduous Broadleaf	0.36%	1.05%
Deciduous Needleleaf	0.23%	0.68%
Urban and Built-up	0.12%	0.36%
Closed Shrublands	0.12%	0.35%
Missing Data	0.06%	0.18%
Permanent Wetlands	0.06%	0.17%
Water	66.08%	--

Notable Features

- There are 16 different land types used in this dataset
- The spatial resolution is 1 kilometer (.6 miles)

Related Datasets

Details

Category
Land

Audio
No

Dataset Source
NASA MODIS

Dataset Developer
Boston University

Visualization Developer
Boston University, NASA

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Directory
FTP Link

Keywords
Land, satellite, MODIS, cover, vegetation